

STANDARD INFORMATION

Standard Number: UL 61010-1 / CSA C22.2 No. 61010-1

Standard Name: Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

Standard Edition and Issue Date: 3rd Edition Dated May 11, 2012

Date of Revision: November 16, 2018 and November 21, 2018

Date of Previous Revision of Standard: UL: April 29, 2016, CSA: Reaffirmed 2017

EFFECTIVE DATE OF NEW/REVISED REQUIREMENTS

Effective Date: **No action is required for currently certified products to maintain certification.**

This SUN is being presented to assist users of the standard to appreciate the significance of the changes made to the standard that will apply should the product described be modified after January 1, 2022

IMPACT, OVERVIEW, AND ACTION REQUIRED

Impact Statement: Effective immediately, this revised standard will be exclusively used for evaluation of new products.

NOTE: These revisions are to adopt Amendment 1 in IEC 61010-1.

NOTE: UL has a revision dated November 21, 2018 to include information inadvertently missed in the November 16, 2018 revisions. The November 21, 2018 revision is administrative. CSA is issuing both revisions under Amendment 1 dated November 21, 2018.

Overview of Changes for November 16, 2018:

- Revised requirements for single fault tests
- Revised requirements for marking on mains supply
- Revised requirements for terminals
- Revised requirement for AC voltage test
- Revised requirements for leakage at high pressure

Overview of changes for November 21, 2018:

- Includes information inadvertently missed in the November 16, 2018 revisions – administrative changes only.

Specific details of new/revise requirements are found in table below.



Client Action:

Current Listings Not Active? – Please immediately identify any current Listing Reports or products that are no longer active and should be removed from our records. We will do this at no charge as long as Intertek is notified in writing prior to the review of your reports.



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CLAUSE	VERDICT	COMMENT
		<i>Additions to existing requirements are <u>underlined</u> and deletions are shown lined-out below.</i>
The following changes reflect the November 16, 2018 revision:		
4	Info	Tests <u>Tests needed to support a RISK assessment (see Clause 17) are carried out in the combinations of conditions and operations determined during the RISK assessment.</u>
4.1		If, when carrying out a conformity test, there is any uncertainty about the exact value of an applied or measured quantity (for example voltage) due to the tolerance: a) manufacturers should ensure that at least the specified test value is applied; b) test houses should ensure that no more than the specified test value is applied.
4.4	Info	Testing in SINGLE FAULT CONDITION General The following requirements apply. c) The equipment shall be operated under the least favourable combination of reference test conditions (see 4.3). These combinations may be different for different faults and they shall be recorded for each test. <u>If the environmental limits of the reference test conditions (see 4.3) do not allow realistic assessment of SINGLE FAULT CONDITIONS, the test shall be conducted at the least favourable RATED environmental conditions of the equipment.</u>
4.4.1		
5	Info	Marking and documentation
5.1	Info	Marking MAINS supply The equipment shall be marked with the following information. Conformity is checked by inspection and by measurement of power or input current to check that the requirements of 5.1.3 c) have been met. The measurement is made at each RATED voltage range with the equipment in the condition of maximum power or current <u>consumption as applicable with all accessories and plug-in modules connected.</u> <u>If the input current varies during the normal operating cycle, the steady-state</u>
5.1.3		



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		<p><u>current is taken as the mean indication of the highest measured r.m.s. value during a 1 min period of the normal operation cycle. To exclude any initial inrush current, the measurement is not made until the current has stabilized (usually after 1 min). Transients are ignored.</u></p>
		<p><i>New clause added;</i></p> <p>D2 Modification to 5.1.3 by replacing the last paragraph with the following:</p> <p>Conformity is checked by inspection and by measurement of power or input current to check that the requirements of 5.1.3 c) have been met. The measurement is made at each RATED voltage range with the equipment consuming the maximum power or current as applicable with all accessories and plug-in modules connected. If the input current varies during the normal operating cycle, the steady-state current is taken as the mean indication of the highest measured r.m.s. value during any 10 second period of the normal operation cycle. To exclude any initial inrush current, the measurement is not made until the current has stabilized (usually after 1 min). Transients are ignored.</p>
5.1.3DV		
		<p>Warning markings</p> <p>Warning markings specified in this standard shall meet the following requirements.</p> <p><u>If the instructions for use state that an OPERATOR is permitted to gain access, using a TOOL, to a part or location which in NORMAL USE may present a HAZARD, there shall be a warning marking indicating that the equipment must be placed in a safe state before access. Symbol 14 shall be used for this purpose with the warning text included in the documentation. Additional symbols may be used to indicate the nature of the HAZARD such as symbol 12, 13, or 17 as appropriate.</u></p> <p><u>Symbols are the preferred marking method over text warnings. Supplemental text may be provided adjacent to the symbol.</u></p> <p>Conformity is checked by inspection.</p>
5.2		
6	Info	Protection against electric shock
6.3	Info	Limit values for ACCESSIBLE parts
		Levels in NORMAL CONDITION
6.3.1		Voltages above the levels of a) are deemed to be HAZARDOUS LIVE if any of the levels of b) or c) are exceeded at the same time.



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		a) The a.c. voltage levels are 33 <u>30</u> V r.m.s., 46,7 <u>42,4</u> V peak and the d.c. voltage level is 70 <u>60</u> V. For equipment intended for use in WET LOCATIONS, the a.c. voltage levels are 16 V r.m.s., 22,6 V peak and the d.c.voltage level is 35 V.
6.3.1DV	Info	<i>D2 National Difference Deleted</i>
		Levels in SINGLE FAULT CONDITION
		Voltages above the levels of a) are deemed to be HAZARDOUS LIVE if any of the levels of b) or c) are exceeded at the same time.
6.3.2		a) The a.c. voltage levels are 55 <u>50</u> V r.m.s., 78 <u>70</u> V peak and the d.c. voltage level is 140 <u>120</u> V. For equipment intended for use in WET LOCATIONS, the a.c. voltage levels are 33 V r.m.s, 46,7 V peak and the d.c. voltage level is 70 V. For voltages of short duration, the duration versus voltage levels are those of Figure 2, measured across a 50 kW resistor.
6.3.2DV	Info	<i>D2 National Difference Deleted</i>
6.6	Info	Connections to external circuits
		TERMINALS for stranded conductors
		<u>TERMINALS for stranded conductors that are intended to be connected during installation, maintenance, or operation of the equipment shall be located or shielded so that there is no possibility of accidental contact between HAZARDOUS LIVE parts of different polarity or between such parts and other ACCESSIBLE parts, even if a strand of a conductor escapes from a TERMINAL. This requirement does not apply to connections that are only to be made at the manufacturing facility.</u>
		<u>Conformity is checked by inspection after fully inserting a stranded conductor</u>
6.6.4		<u>a) with the maximum length of insulation removed as specified by the equipment manufacturer, or</u> <u>b) with an 8 mm length of insulation removed if no specification is given by the equipment manufacturer.</u>
		<u>With one of the strands free, the free strand shall not touch parts of different polarity or other ACCESSIBLE parts, when bent in every possible direction, without tearing back the insulation or making sharp bends.</u>
		TERMINALS of circuits carrying HAZARDOUS LIVE voltage or current shall be anchored, fitted or designed so that conductors will not work loose when they are tightened, loosened or when connections are made.
		Conformity is checked by manual test and inspection.



CLAUSE	VERDICT	COMMENT
6.7	Info	Insulation requirements
6.7.1	Info	The nature of insulation
		CREEPAGE DISTANCES
6.7.1.3		<u>A CREEPAGE DISTANCE may be split in several portions of different materials and/or have different POLLUTION DEGREES if one of the CREEPAGE DISTANCES is dimensioned to withstand the total voltage or if the total distance is dimensioned according to the material having the lowest CTI and the highest POLLUTION DEGREE.</u> See Annex C for details of how to measure CREEPAGE DISTANCES.
6.8	Info	Procedure for voltage tests
		General
		The foil is applied after the humidity preconditioning (if applicable) and connected to the low TERMINAL of the test voltage generator.
6.8.1		<u>When verifying a CLEARANCE within equipment, it is necessary to ensure that the specified voltage appears at the CLEARANCE. PROTECTIVE IMPEDANCE, impedances and voltage-limiting devices in parallel with the insulation to be tested may be disconnected.</u> The equipment is not energized during the tests. When verifying CLEARANCES, the values for test voltages given in 6.7 apply to tests performed at 2 000 m. For other test site altitudes, the corrections of Table 10 are applied for CLEARANCES but not for tests of solid insulation.
6.8.3	Info	Test procedures
		The a.c. voltage test
6.8.3.1		<u>The voltage tester shall have a regulated output capable of maintaining the test voltage throughout the test. The waveform of the test voltage shall be substantially sinusoidal. This requirement is fulfilled if the ratio between the peak value and the r.m.s. value is $\sqrt{2} \pm 3 \%$.</u> <u>The a.c. voltage test is performed at the RATED MAINS frequency, but for equipment RATED for MAINS frequencies including 50 Hz and 60 Hz, a test at either 50 Hz or at 60 Hz is sufficient.</u> The test voltage is raised uniformly from 0 V to the specified value within 5 s and held at that value for at least the specified time. No flashover of CLEARANCES or breakdown of solid insulation shall occur during the test.



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		The d.c. voltage test
6.8.3.2		<p>The d.c. test voltage shall be substantially free of ripple. This requirement is fulfilled if the ratio between the peak value of the voltage and the average value is $1,0 \pm 3 \%$.</p> <p>The d.c. test voltage is raised uniformly from 0 V to the specified value within 5 s and held at that value for at least 1 min <u>the specified time</u>.</p> <p>No flashover of CLEARANCES or breakdown of solid insulation shall occur during the test.</p>
11	Info	Protection against HAZARDS from fluids and solid foreign objects
		<i>New section added;</i>
11.6		Equipment RATED with a degree of ingress protection (IP code)
		<p>This section contains requirements for equipment rated with a degree of ingress protection (see standard for details).</p>
11.7	Info	Fluid pressure and leakage
		Leakage and rupture at high pressure
		<p><u>The test pressure (Ptest) is the maximum pressure (Pmax) multiplied by the applicable factor of Figure 16. Any overpressure safety device which could limit the test pressure is deactivated during the test.</u></p>
11.7.2		<p>The test pressure is raised gradually to Ptest and is held at that value for 1 min. The sample shall not burst, suffer from permanent (plastic) deformation, or leak. <u>Provided that the test pressure is maintained, leakage at a gasket during this test is not considered a failure unless it occurs at a pressure below 75 % of Ptest, or below Pmax, whichever is greater.</u></p>
		<p>Conformity is checked as specified in EN 378-2 or IEC 60335-2-89 as applicable. <u>Pneumatic overpressure tests should only be conducted if no other option is available. This test can be extremely hazardous. The sudden release of stored energy due to a rupture of the test specimen can lead to severe injury or death. The stored energy in the pressurized system should be understood and appropriate safeguards put in place. These tests should only be conducted behind an explosion shield or within a suitable enclosure to protect laboratory personnel from flying debris, audible hazards, and in extreme cases the blast wave.</u></p>
		<i>New Figure added;</i>
Figure 16		Ratio between test pressure and maximum working pressure
		<p>See standard for details.</p>



CLAUSE	VERDICT	COMMENT
12	Info	Protection against radiation, including laser sources, and against sonic and ultrasonic pressure
12.2	Info	Equipment producing ionizing radiation
12.2.1	Info	Ionizing radiation
		General
		Equipment containing or generating ionizing radiation (from either radioactive sources or X-radiation) shall meet the following requirements.
12.2.1.1		<p>a) If it is intended to emit radiation, it shall meet the requirements of 12.2.1.2. Alternatively, if it is within the scope of IEC 60405 <u>62598</u>, it shall be tested, classified, and marked according to IEC 60405 <u>62598</u>.</p> <p>b) If it uses or generates radiation but only emits stray radiation, it shall meet the requirements of 12.2.1.3.</p> <p>Conformity is checked by inspection of the IEC 62598 compliance documentation or as specified in 12.2.1.2 or 12.2.1.3, as applicable.</p>
		<i>New clause added;</i>
		Optical radiation
12.3		<p>Equipment with lamps and lamp systems emitting ultraviolet, visible, or infrared radiation, including light emitting diodes, shall not permit unintentional escape of radiation that could cause a HAZARD. The radiation sources shall be assessed in accordance with IEC 62471 except for sources considered to be safe (Table 22) or conditionally safe (Table 23). Lamp and lamp systems assessed to be in Risk Groups 1, 2 or 3 of IEC 62471 shall be labelled in accordance with IEC TR 62471-2. If the size or design of the lamp or lamp systems makes labelling impractical, symbol 14 shall be marked on the equipment and the label shall be included in the documentation.</p> <p>Information on protective measures, restrictions on use, and operating instructions that may be necessary shall be provided, including the applicable conditions of use of Table 23.</p> <p>Conformity is checked by inspection and if necessary, by measurement of the optical radiation to determine no hazard exists.</p>
		<i>New table added;</i>
Table 22		Lamp or lamp systems considered photobiologically safe
		See standard for details.



CLAUSE	VERDICT	COMMENT
		<i>New table added;</i>
Table 23		Lamp or lamp systems considered photobiologically safe under certain conditions See standard for details.
13	Info	Protection against liberated gases and substances, explosion and implosion Poisonous and injurious gases and substances Equipment shall not liberate dangerous amounts of hazardous substances in NORMAL CONDITION and in SINGLE FAULT CONDITION. <u>If potentially-hazardous substances are liberated, the OPERATOR shall not be directly exposed to a quantity of the substance that could cause harm.</u>
13.1		<u>If NORMAL operation of the equipment requires the discharge of hazardous substances, and if that discharge is intended to be managed by the RESPONSIBLE BODY in accordance with the manufacturer's instructions, then such discharge is not considered to be liberation of hazardous substances.</u> Conformity is checked by inspection of the manufacturer's documentation. The wide variety of gases and substances makes it impossible to specify conformity tests based on limit values, so reference should be made to tables of occupational threshold limit values.
Annex K	Info	Insulation requirements not covered by 6.7
K.1	Info	Insulation for MAINS CIRCUITS CLEARANCES and CREEPAGE DISTANCES for MAINS CIRCUITS CLEARANCES and CREEPAGE DISTANCES for MAINS CIRCUITS shall meet the values of the following tables as applicable: a) for MAINS CIRCUITS of OVERVOLTAGE CATEGORY II, with nominal supply voltages above 300 V, Table K.2; b) for MAINS CIRCUITS of OVERVOLTAGE CATEGORY III, Table K.3; c) for MAINS CIRCUITS of OVERVOLTAGE CATEGORY IV, Table K.4.
K.1.2		The values in the following tables are for BASIC INSULATION and SUPPLEMENTARY INSULATION. Values for REINFORCED INSULATION shall be twice the values for BASIC INSULATION. If the equipment is RATED to operate at an altitude greater than 2 000 m, the CLEARANCES shall be multiplied by the applicable factor of Table K.1. <u>Conformity is checked by inspection and measurement and, in case of doubt, by the impulse voltage test of 6.8.3.3 or the a.c. test of 6.8.3.1 with a duration of at</u>



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		<p><u>least 5 s using the applicable test voltage from Table K.16 for the required CLEARANCE.</u></p> <p><u>No flashover of CLEARANCES shall occur during the test.</u></p>
Annex DVE	Info	Permanently installed equipment
DVE.1	Info	General
DVE.1.1		<p>These requirements cover permanently installed, OPEN EQUIPMENT or enclosed-type rated 1000 volts or less intended for installation in accordance with the National Electrical Code, ANSI/NFPA 70 and the Canadian Electrical Code, C22.1.</p> <p><i>New clause added;</i></p>
DVE.1.5		<p>These safety requirements do not apply to equipment intended for use in utility substations or equivalent areas that have impulse voltages greater than Overvoltage Category IV.</p>
DVE.3	Info	Marking and documentation
DVE.3.1	Info	Marking
		<i>New section added;</i>
DVE.3.1.2		<p>Current transformer warning and correlation marking</p> <p>This section contains requirements for current transformer warning and correlation marking (see standard for details).</p>
DVE.7	Info	Equipment temperature limits and resistance to heat
DVE.7.1	Info	Conduct of temperature tests
		<i>New clause added;</i>
DVE.7.1.1		<p>OPEN EQUIPMENT shall be tested within an enclosure with dimensions as specified in the OPEN EQUIPMENT'S installation instructions or tested under the referenced test ambient condition.</p>
DVE.8	Info	Components and subassemblies
DVE.8.1	Info	Current transformers
		<i>New clause added;</i>
DVE.8.1.1		<p>Listed energy monitoring current transformers intended for field installation shall be used when installed within distribution and control equipment such as panel boards, switchgears, industrial control equipment, and energy-monitoring/management equipment.</p> <p>Accessory current transformers for OPEN EQUIPMENT intended only for field installation within the same enclosure as the OPEN EQUIPMENT shall be:</p> <p>a) evaluated to the requirements as outlined in DVE.8.1.2; or</p>



CLAUSE	VERDICT	COMMENT
		b) listed as energy monitoring current transformers.
		<i>New clause added;</i>
		Accessory current transformers for field installation with OPEN EQUIPMENT, when evaluated to the requirements of this standard, shall comply with the following additional provisions:
DVE.8.1.2		a) The case or potting material shall provide minimum basic insulation between the external surface of the current transformer and the internal coil or sensing circuit. b) If the current transformer is intended for installation on bare (uninsulated) conductor, its case or potting material shall be rated for minimum 105°C, Electrical Relative Thermal Index (RTI). c) If the current transformer is intended for installation on insulated conductor, its case or potting material shall be rated for at least the same temperature as the maximum temperature rating of the conductor insulation (60°C, 75°C, or 90°C). d) Current transformer field wiring leads and electrical sleeving shall be rated minimum the primary voltage rating of the current transformer. e) The temperature rating of the current transformer field wiring leads and electrical sleeving shall not be lower than 90°C.
		CUSTOMERS PLEASE NOTE: This Table and column “Verdict” can be used in determining how your current or future production is or will be in compliance with new/revised requirements.